5.0 DATA REQUIREMENTS FOR THE REACH / RESERVOIR ROUTING MODULE (RCHRES)

Data requirements for the Pervious Land Upland loading module are described below. Table 2-8 previously provided the links between subbasin monitoring data components and model data requirements in RCHRES.

5.1 Section HYDR

Section HYDR performs the hydraulic reach routing calculations.

Time Series 5.1.1

PREC — Precipitation in inches or mm. See discussion for PERLND Section PWATER.

POTEV — Potential evaporation in inches or mm. Factored pan evaporation data or measured local lake evaporation data are useful for this time series. This time series functions as a maximum limit for reach evaporation which will be fully satisfied by the model when water is present in the reach.

IVOL — Reach inflows in acre-feet or cubic meters. This time series input accounts for inflows from outside the watershed or from upstream reaches if the simulation is broken up into smaller modeling runs.

5.1.2 Tabular Data

5.1.2.1 Table HYDR-PARM1

This table contains a number of program control flags to specify various options for auxiliary parameters to be calculated and the method to be used for determining reach outflows.

5.1.2.2 Table HYDR-PARM2

FTBDSN — This is a control parameter to identify the applicable F-Table (reach outflow control).

FTABNO — The F-Table contains the geometric and hydraulic properties of the RCHRES.

LEN This parameter is the length of the RCHRES in miles or kilometers. It is used for a calculation which estimates the hydraulic radius used in bed shear stress and shear velocity.

DELTH This parameter is the drop in water elevation in feet or meters from the upstream to the downstream extremities of the RCHRES. It is used if section OXRX is active and reaeration is being computed using the Tsivoglou-Wallace equation; or if section SEDTRN is active and sandload transport capacity is being computed using either the Toffaleti or Colby method.

STCOR This value is the correction to the RCHRES depth provided in the flow routing table to adjust the value to actual stage or topographic elevation for reporting purposes. Units are feet or meters.

KS This is the weighting factor for hydraulic routing. A KS value of 0.5 has proven to work well during numerous simulation projects.

DB50 This parameter is the median diameter of the bed sediment in inches or mm and is assumed constant throughout the run. This value is used to:

1) Calculate the bed shear stress if the RCHRES is a lake.
2) Calculate the rate of sand transport if the Colby or Toffaleti methods are used.

Note that this value is used for calculation rather than the value for sand particle diameter supplied in Table-type SAND-PM (for Section SEDTRN).

5.1.2.3 Table MON-CONVF

This table provides a monthly factor to scale outflow as a fraction of the F-table value. This is one of several options to vary the control of outflow during a continuous simulation.

5.1.2.4 Table HYDR-INIT

VOL This parameter is the initial volume of water in the RCHRES in acre-feet or cubic meters.

The remaining parameters in this table control how outflows from a reach are determined as functions of volume or time or both.

5.2 Section ADCALC

5.2.1 Table ADCALC-DATA

CRRAT This parameter is the ratio of maximum velocity to mean velocity in the RCHRES cross section under typical flow conditions. The ratio is used to control how entrained constituents discharge from the reach during a given simulation interval.

VOL This parameter is the initial volume of water in the RCHRES at the start of the simulation. Input of this value is not necessary if section HYDR is active.

5.3 Section CONS

This section is used to specify input data to simulate a conservative constituent. Simulation of a conservative constituent or tracer can be valuable to gauge the calibration of modeled flows in the system. Chloride data are commonly used in this manner. Dye tracer studies are another application.

5.3.1 Time Series

ICON Conservative constituent inflows. Units are user defined but should be consistent with the specifications in Table CONS-DATA.

5.3.2 Tabular Data

5.3.2.1 Table NCONS

NCONS Specifies the number of conservative constituents being simulated and is only needed if more than one constituent is simulated.

5.3.2.2 Table CONS-DATA

This table allows user specification of the name of the conservative constituent (CONID), the initial concentration (CON), concentration units (CONCID), mass units (QTYID), and a conversion factor to produce the concentration units from QTYID based on volume in ft3 or m3.

If the constituent provides the alkalinity time series for section PHCARB, CONCID must be mg/l as $CaCO_3$.

5.4 Section HTRCH

5.4.1 Time Series

SOLRAD Solar radiation (heat flux) in langleys

CLOUD Cloud cover expressed as fraction in tenths (range 0 - 10)

GATMP Air temperature in EC

DEWTMP Dewpoint temperature in EC

WINMOV Wind speed in meters

Solar radiation and air temperature data may only be available as a daily total or max/min and may not be available in increments to match the simulation time step. In this case, some preprocessing will be required to generate solar radiation for daylight hours or temperature variation throughout the day.

5.4.2 Tabular Data

5.4.2.1 Table HEAT-PARM

ELEV This parameter is the mean elevation of the reach. It is used to calculate a pressure correction factor for conductive-convective heat transport. Units are feet or meters.

ELDAT This parameter is the difference in elevation between the RCHRES and the air temperature gage. This value is only needed if the elevation difference is significant. Units are feet or meters.

CFSAEX This is a correction factor for solar radiation applied to the SOLRAD time series. The model initially assumes that 97% of incident radiation is absorbed. This factor can account for differences between radiation received at the gage and the reach and can be used to further account for shading of the reach.

KATRAD This is the atmospheric longwave radiation coefficient. Model documentation mentions a typical value of 9.

KCOND This parameter is the conduction-convection heat transport coefficient, with a typical range of 1 - 20.

KEVAP This parameter is the evaporation coefficient, with a typical range of 1 - 5.

5.4.2.2 Table HEAT-INIT

TW This parameter is the initial water temperature in EF or EC.

AIRTMP This parameter is the initial air temperature in EF or EC.

Values in this table apply only to the start of the simulation. This table can probably be omitted.

5.5 Section SEDTRN

5.5.1 Time Series

ISED Inflows of sand, silt, clay in tons or tonnes. Used primarily for inflows from sources external to the watershed or to provide continuity when the simulation is performed in several segments.

5.5.2 Tabular Data

5.5.2.1 Table SANDFG

This table provides a flag that indicates the method that will be used for sandload simulation. The Toffaleti method, Colby method, or a user-specified power function method may be used. Note that if the Colby method is used and parameters such as bed sediment diameter, hydraulic radius and average velocity fall outside of the applicable range for which the data were developed, the Toffaleti routines will be automatically called to complete the calculation.

5.5.2.2 Table SED-GENPARM

BEDWID This parameter is the width of the cross-section over which HSPF will assume bed sediment is deposited regardless of stage, top-width, etc. It is used to estimate the depth of bed sediment (BEDDEP). Units are feet or meters.

BEDWRN This is the bed depth which, if exceeded (e.g., through deposition) will cause a warning message to be printed. This parameter is included as a means to identify modeling problems. Units are feet or meters.

POR This parameter is the porosity of the bed (volume voids/total volume). It is used to estimate bed depth.

5.5.2.3 Table SED-HYDPARM

This table is only required to provide LEN, DELTH, and DB50 if Section HYDR is not active. Normally these parameters are supplied in Table HYDR-PARM2, where they are defined.

5.5.2.4 Table SAND-PM

D This parameter is the effective diameter of the transported sand particles. This parameter is not used. DB50 in Table HYDR-PARM2 is used. Units are inches or mm.

W This parameter is the particle fall velocity in still water. Units are in/sec or mm/sec.

RHO This is the density of the sand particles. Units are g/cm^3.

KSAND These parameters are the coefficient and exponent for the user-defined sandload

EXPSND power function formula.

5.5.2.5 Table SILT-CLAY-PM

This table must be supplied twice; first for silt, then for clay.

D This parameter is the effective diameter of the particles. Units are inches or mm.

W This parameter is the particle fall velocity in still water. Units are in/sec or mm/sec.

RHO This is the density of the particles. Units are g/cm^3.

TAUCD This is the critical bed shear stress for deposition. Above this stress, there will be no deposition; as the stress drops below this value to zero, deposition will gradually increase to the value implied by the fall velocity in still water.

TAUCS This parameter is the critical bed shear stress for scour. Below this value, there will be no scour; above it, scour will steadily increase. (In general TAUCD should be less than or equal to TAUCS.)

M This parameter is the erodibility coefficient of the sediment. Units are kg/m^2 or lb/ft^2.

5.5.2.6 Table SSED-INIT

The three values supplied are the initial concentrations (in suspension) of sand, silt, and clay, respectively. Units are mg/l.

5.5.2.7 Table BED-INIT

BEDDEP This parameter is the initial total depth (thickness) of the bed. Units are feet or meters.

The three values supplied under <fracsand>, <fracsilt>, and <fracclay> are the initial fractions (by weight) of sand, silt, and clay in the bed material. Units are weight fraction.

5.6 Section GQUAL

Section GQUAL is capable of simulating a number of processes for a quality constituent within the reach. A constituent may be either water or sediment related and a number of different processes may be considered. Advection of dissolved materials may be simulated. Decay processes such as hydrolysis, oxidation, photolysis, volatilization, biodegradation, and generalized first-order decay may be considered. Production of other chemicals (daughter products) resulting from the decay processes within the water column may also be simulated. Sediment related processes include advection of adsorbed suspended material, deposition and scour of adsorbed material, decay of suspended and bed material, and adsorption/desorption between the dissolved and sediment-associated phase. The generalized quality routines may be adapted to any constituents for which data are available. The utility of this routine is that the modeling approach can be adapted to consider only the most important processes or simply the processes for which data are available.

A simple approach to modeling nutrients within the reach might employ only a first-order decay process to simulate the net removal of the nutrients from the water column. Guidance for selection of a first-order decay rate might be obtained from monitoring data collected during a time period when inflow and outflow data for a reach are available and no additional loadings occurred.

5.6.1 Time Series

IDQUAL	Dissolved WQ constituent (e.g., $N0_3$, $P0_4$)
ISQUAL	WQ constituent on suspended silt
PHVAL	pH
ROC	Free radical O_2 concentration in mole/l.
BIO	Biomass concentration involved in biodegradation in mg/l.
PHYTO	Phytoplankton concentration in mg/l.

Required time series inputs for GQUAL are determined by the processes to be simulated and whether or not other model sections are active. Many inputs to GQUAL are optionally provided as a single value, a table of monthly values, or a time series of values.

5.6.2 Tabular Data

5.6.2.1 Table GQ-GENDATA

This table is a modeling control table which provides the model with flags to indicate the number of constituents to be simulated by GQUAL and the source of data such as single or monthly value input tables or time series source which may be required by different simulation options available within GQUAL.

1) Water temperature data may be provided/computed by another model section.
2) pH data are required if hydrolysis is considered for a dissolved quality constituent.
3) Free radical oxygen data are required if oxidation is considered for a dissolved quality constiuent.

Cloud cover, total sediment concentration, phytoplankton concentration and latitude are required if photolysis is considered for a dissolved quality constituent. If needed, the latitude is provided in this table.

5.6.2.2 Table GQ-QALDATA

GQID Name of quality constituent.

DQAL Initial concentration of quality constituent. Units as per CONCID.

CONCID Concentration units (implied that it is "per liter") e.g."mg"(/l).

CONV Factor to convert from Qty/Vol to concentration units. Conc= CONV* Qty/Vol (in English system, Vol is in ft^3) (in Metric system, Vol is in m^3).

QTYID Name of "Qty" unit for qual.

5.6.2.3 Table GQ-QALFG

This table contains program control flags to indicate whether hydrolysis, oxidation by free radical oxygen, photolysis, volatilization, biodegradation, or general first order decay is considered for dissolved quality constituents. A flag also indicates whether or not the quality constituent is associated with sediment so that adsorption/desorption is considered.

5.6.2.4 Table GQ-FLG2

This table contains program control flags that indicate whether or not the quality constituent is a "daughter" product through each of the five available decay processes (hydrolysis, oxidation, photolysis, biodegradation, or general first-order decay). If biodegradation is considered, the source of biomass data as a single constant, monthly varying input, or input time series is identified.

5.6.2.5 Table GQ-HYDPM

This table provides parameters for hydrolysis.

KA Second order acid rate constant (pH=5) for hydrolysis, units are 1/M-sec.

KB Second order base rate constant (pH=9) for hydrolysis, units are 1/M-sec

KN First order rate constant of neutral reaction (pH=7) with water, units are 1/sec.

THHYD Temperature correction coefficient for hydrolysis

5.6.2.6 Table GQ-ROXPM

This table provides parameters for oxidation.

KOX Second order rate constant for oxidation by free radical oxygen, units are 1/M-sec.

THOX Temperature correction coefficient for oxidation by free radical oxygen

5.6.2.7 Table GQ-PHOTPM

This table provides parameters for photolysis.

PHOTPM(1)-PHOTPM(18)
Molar absorption coefficients for quality constituent for 18 wavelength ranges of light.

PHOTPM(19) Quantum yield for the qual in air-saturated pure water.

PHOTPM(20) Temperature correction coefficient for photolysis.

5.6.2.8 Table GQ-CFGAS

This table provides a parameter for volatilization of a dissolved quality constituent.

CFGAS Ratio of volatilization rate to oxygen reaeration rate

5.6.2.9 Table GQ-BIOPM

This tables provides parameters for biodegradation of a dissolved quality constituent.

BIOCON Second order rate constant for biomass concentration causing biodegradation, units are 1/mg/day.

THBIO Temperature correction coefficient for biodegradation

BIO Concentration of biomass causing biodegradation, units are mg/l.

5.6.2.10 Table MON-BIO

This table provides monthly concentrations of biomass causing biodegradation of a dissolved quality constituent. Units are mg/l.

5.6.2.11 Table GQ-GENDECAY

This table provides parameters for a generalized first order decay process for a dissolved quality constituent.

FSTDEC First order decay rate, units are 1/day.

THFST Temperature correction coefficient for first-order decay

5.6.2.12 Table GQ-SEDDECAY

This table provides parameters for decay of constituent adsorbed to sediments.

ADDCPM(1) Decay rate for qual adsorbed to suspended sediment, units are 1/day.

ADDCPM(2) Temperature correction coefficient for decay of qual on suspended sediment

ADDCPM(3) Decay rate for qual adsorbed to bed sediment, units are 1/day.

ADDCPM(4) Temperature correction coefficient for decay of qual on bed sediment

5.6.2.13 Table GQ-KD

This table provides distribution coefficients for the quality constituent associated with suspended sand, suspended silt, suspended clay, bed sand, bed silt, and bed clay. Units are 1/mg.

5.6.2.14 Table GQ-ADRATE

This table provides the transfer rates between adsorbed and desorbed states for the quality constituent associated with suspended sand, suspended silt, suspended clay, bed sand, bed silt, and bed clay. Units are 1/day.

5.6.2.15 Table GQ-ADTHETA

This table provides temperature correction coefficients for adsorption/desorption on suspended sand, suspended silt, suspended clay, bed sand, bed silt, and bed clay.

5.6.2.16 Table GQ-SEDCONC

This table proivdes the initial concentration of the quality constituent on suspended sand, suspended silt, suspended clay, bed sand, bed silt, and bed clay. Units are the user defined concentration unit per mg.

5.6.2.17 Table GQ-VALUES

This table provides a single constant value for the data type specified.

TWAT	Water temperature, units are EF or EC
PHVAL	pH
ROC	Free radical oxygen concentration, units are mole/l.
CLD	Cloud cover in tenths (range 0 - 10)
SDCNC	Total suspended sediment concentration, units are mg/l.
PHY	Phytoplankton concentration (as biomass), units are mg/l.

5.6.2.18 Table MON-WATEMP

This table provides monthly values for water temperature in EF or EC.

5.6.2.19 Table MON-PHVAL

If there is hydrolysis, this table provides monthly values for pH.

5.6.2.20 Table MON-ROXYGEN

If there is oxidation, monthly values for free radical oxygen concentration are supplied in this table. Units are mole/l.

5.6.2.21 Table GQ-ALPHA

If photolysis is considered, this table provides base absorption coefficients for 18 wavelengths of light passing through clear water. Units are 1/cm.

5.6.2.22 Table GQ-GAMMA

If photolysis is considered, this table provides increments to the base absorbance coefficient (Table-type GQ-ALPHA) for light passing through sediment-laden water for 18 wavelengths of light. Units are 1/mg-cm.

5.6.2.23 Table GQ-DELTA

If photolysis is considered, this table provides increments to the base absorption coefficient (Table- type GQ-ALPHA) for light passing through plankton-laden water for 18 wavelengths of light. Units are 1/mg-cm.

5.6.2.24 Table GQ-CLDFACT

If photolysis is considered, this table provides values of light extinction efficiency of cloud cover for each of 18 wavelengths as a fraction from 0 - 1.

5.6.2.25 Table MON-CLOUD

If photolysis is considered, this table provides monthly values of average cloud cover. Units are tenths (range 0 - 10).

5.6.2.26 Table MON-SEDCONC

If photolysis is considered, this table provides monthly average suspended sediment concentration values. Units are mg/l.

5.6.2.27 Table MON-PHYTO

If photolysis is considered, this table provides monthly values of phytoplankton concentration. Units are mg/l.

5.6.2.28 Table SURF-EXPOSED

This table is required if Section HTRCH is inactive.

CFSAEX This factor is used to adjust the input solar radiation to make it applicable to the RCHRES; for example, to account for shading of the surface by trees or buildings.

5.6.2.29 Table OX-FLAGS

This table is required if there is volatilization. Input described under Section OXRX.

5.6.2.30 Table ELEV

This table is required if there is volatilization. Input described under Section OXRX.

5.6.2.31 Table OX-CFOREA

This table is required if there is volatilization. Input described under Section OXRX.

5.6.2.32 Table OX-TSIVOGLOU

This table is required if there is volatilization. Input described under Section OXRX.

5.6.2.33 Table OX-LEN-DELTH

This table is required if there is volatilization. Input described under Section OXRX.

5.6.2.34 Table OX-TCGINV

This table is required if there is volatilization. Input described under Section OXRX.

5.6.2.35 Table OX-REAPARM

This table is required if there is volatilization. Input described under Section OXRX.

5.6.2.36 Table GQ-DAUGHTER

This table specifies the relationship between parent and daughter compounds resulting from hydrolysis, oxidation by free radical oxygen, photolysis, biodegradation, and general first order decay.

5.7 Section RQUAL

The RQUAL section of RCHRES provides a more detailed approach to biochemical transformations in the waterbody. RQUAL is the parent section controlling the execution of sections OXRX, NUTRX, PLANK, and PHCARB. These sections are dependent on the results of the previous sections so that NUTRX cannot be activated unless OXRX is also activated, etc.

5.7.1 Tabular Data

5.7.1.1 Table BENTH-FLAG

This table contains a program control flag to allow benthal influences to be considered.

5.7.1.2 Table SCOUR-PARMS

SCRVEL The velocity above which effects of scouring on benthal release rates is considered. Units are feet/sec or meters/sec.

SCRMUL Multiplier to increase benthal releases during scouring.

5.8 Section OXRX

5.8.1 Time Series

IDOX Inflow dissolved O_2 concentration, units are mg/l.

EBOD Inflow BOD concentration, units are mg/l.

5.8.2 Tabular Data

5.8.2.1 Table OX-FLAGS

This table contains a program control flag that indicates the method used to calculate reaeration coefficient for free-flowing streams.

1) Means Tsivoglou method is used
2) Means Owens, Churchill, or O'Connor-Dobbins method is used depending on velocity and depth of water
3) Means coefficient is calculated as a power function of velocity and/or depth; user inputs exponents for velocity and depth and an empirical constant (REAK)

5.8.2.2 Table OX-GENPARM

KBOD20 Unit BOD decay rate at 20EC, units are 1/hour

TCBOD Temperature correction coefficient for BOD decay

KODSET Rate of BOD settling, units are feet/hr or meters/hr.

SUPSAT Allowable dissolved oxygen supersaturation expressed as a multiple of DO saturation concentration

5.8.2.3 Table ELEV

ELEV Elevation of the reach in feet or meters if section HTRCH is not active.

5.8.2.4 Table OX-BENPARM

BENOD Benthic oxygen demand at 20EC. Units are mg/m2-hr

TCBEN Temperature correction coefficient for benthic oxygen demand

EXPOD Exponential factor in the dissolved oxygen term of the benthic oxygen demand equation.

BRBOD(1) Benthic release of BOD at high oxygen concentration. Units are mg/m2-hr.

BRBOD(2) Increment to benthic release of BOD under anaerobic conditions. Units are mg/m2-hr.

EXPREL Exponential factor in the dissolved oxygen term of the benthic BOD release equation.

5.8.2.5 Table OX-CFOREA

CFOREA is a correction factor in the lake reaeration equation, to account for good or poor circulation characteristics.

5.8.2.6 Table OX-TSIVOGLOU

REAKT This parameter is the empirical constant in Tsivoglou's equation for reaeration (escape coefficient). Units are 1/ft.

TCGINV This parameter is the temperature correction coefficient for surface gas invasion.

5.8.2.7 Table OX-LEN-DELTH

This table provides parameters for a non-lake reach. Table is only needed if section HYDR is not active.

LEN This parameter is the length of the RCHRES in mile or kilometers.

DELTH This is the (energy) drop over its length in feet or meters.

5.8.2.8 Table OX-TCGINV

This table is used if the Owen/Churchill/O'Connor method is used for stream reaeration.

TCGINV This parameter is the temperature correction coefficient for surface gas invasion.

5.8.2.9 Table OX-REAPARM

This table is used if a user-defined reaeration formula is used.

TCGINV Temperature correction coefficient for surface gas invasion

REAK Empirical constant for equation used to calculate reaeration coefficient, units are 1/hr.

EXPRED Exponent to depth used in calculation of reaeration coefficient

EXPREV Exponent to velocity used in calculation of reaeration coefficient

5.8.2.10 Table OX-INIT

DOX Dissolved oxygen, units are mg/l.

BOD Biochemical oxygen demand, units are mg/l.

SATDO Dissolved oxygen saturation concentration, units are mg/l.

5.9 Section NUTRX

5.9.1 Time Series

IN03, INH3, IN02, IP04, optional WQ constituent inflows in lb or kg.

5.9.2 Tabular Data

5.9.2.1 Table NUT-FLAGS

TAMFG	If on, total ammonia is simulated
NO2FG	If on, nitrite is simulated
PO4FG	If on, ortho-phosphorus is simulated
AMVFG	If on, ammonia vaporization is enabled
DENFG	If on, denitrification is enabled
ADNHFG	If on, NH_4 adsorption is simulated.
ADPOFG	If on, PO_4 adsorption is simulated.
PHFLAG	Source of pH data (1=time series, 2=constant, 3=monthly values).

5.9.2.2 Table CONV-VAL1

CVBO	Conversion from milligrams biomass to milligrams oxygen. Units are mg/mg.
CVBPC	Conversion from biomass expressed as phosphorus to carbon equivalency. Units are moles/mole.
CVBPN	Conversion from biomass expressed as phosphorus to nitrogen equivalency. Units are moles/mole.
BPCNTC	Percentage, by weight, of biomass which is carbon

5.9.2.3 Table NUT-BENPARM

BRTAM	Benthic release of total ammonia. (1) indicates aerobic rate and (2) indicates anaerobic rate. Units are mg/m^2-hr
BRPO4	Benthic release of ortho-phosphate. Subscripts same as BRTAM. Units are mg/m^2-hr.

ANAER Concentration of dissolved oxygen below which anaerobic conditions exist. Units are mg/l.

5.9.2.4 Table NUT-NITDENIT

KTAM20 Nitrification rate of ammonia at 20EC. Units are 1/hr.

KNO220 Nitrification rates of nitrite at 20EC. Units are 1/hr.

KNO320 Denitrification rate at 20EC. Units are 1/hr.

TCNIT The temperature correction coefficient for nitrification.

TCDEN The temperature correction coefficient for denitrification.

DENOXT The dissolved oxygen concentration threshold for denitrification.

5.9.2.5 Table NUT-NH3VOLAT

EXPNVG This parameter is the exponent in the gas layer mass transfer coefficient equation for NH_3 volatilization.

5.9.2.6 Table MON-PHVAL

This table is used if NH_3 is simulated and monthly values of pH are being input.

5.9.2.7 Table NUT-BEDCONC

This table is used if NH_4-N or PO_4-P adsorption is simulated.

BNH4(1-3) These parameters are the constant bed concentrations of NH_4-N adsorbed to sand, silt, and clay. Units are mg/kg.

BPO4(1-3) These parameters are the constant bed concentrations of PO_4-P adsorbed to sand, silt, and clay. Units are mg/kg.

5.9.2.8 Table NUT-ADSPARM

ADNHPM(1-3) Partition coefficients for NH_4-N adsorbed to sand, silt, and clay. Units are ml/g.

ADPOPM(1-3) Partition coefficients for PO_4-P adsorbed to sand, silt, and clay. Units are ml/g.

5.9.2.9 Table NUT-ADSINIT

SNH4(1-3) Initial concentrations of NH_4-N adsorbed to sand, silt, and clay. Units are mg/kg.

SPO4(1-3) Initial concentrations of PO_4-P adsorbed to sand, silt, and clay. Units are mg/kg.

5.9.2.10 Table NUT-DINIT

NO3 The initial concentration of nitrate (as N). Units are mg/l.

TAM The initial concentration of total ammonia (as N). Units are mg/l.

NO2 The initial concentration of nitrite (as N). Units are mg/l.

PO4 The initial concentration of ortho-phosphorus (as P). Units are mg/l.

PHVAL The constant (annual) or initial value of pH.

5.10 Section PLANK

5.10.1 Tables

5.10.1.1 Table PLNK-FLAGS

This table contains a number of program control flags. The flags determine whether phytoplankton, zooplankton and benthic algae are simulated. The influence of sediment washload on light extinction may be simulated. Ammonia retardation of nitrogen limited growth may be simulated and ammonia can be included as part of available nitrogen supply in nitrogen limited growth calculations. The linkage

between carbon dioxide and phytoplankton growth can be decoupled. One model parameter is included in this table.

ZFOOD The quality of zooplankton food rated as high, medium or low. This parameter controls the zooplankton assimilation efficiency.

5.10.1.2 Table SURF-EXPOSED

This table is needed only if section HTRCH is not active.

CFSAEX This is a correction factor for solar radiation applied to the SOLRAD time series. The model initially assumes that 97% of incident radiation is absorbed. This factor can account for differences between radiation received at the gage and the reach and can be used to further account for shading of the reach.

5.10.1.3 Table PLNK-PARM1

RATCLP Ratio of chlorophyll % content of biomass to phosphorus content

NONREF Nonrefractory fraction of algae and zooplankton biomass

LITSED Multiplication factor to total sediment concentration to determine sediment contribution to light extinction. Units are 1/mg-ft.

ALNPR Fraction of nitrogen requirements for phytoplankton growth satisfied by nitrate

EXTB Base extinction coefficient for light. Units are 1/ft or 1/meter.

MALGR Maximal unit algal growth rate. Units are 1/hr.

5.10.1.4 Table PLNK-PARM2

CMMLT Michaelis-Menten constant for light limited growth in langleys/min.

CMMN Nitrate Michaelis-Menten constant for nitrogen limited growth. Units are mg N/l.

CMMNP Nitrate Michaelis-Menten constant for phosphorus limited growth. Units are mg N/l.

CMMP Phosphate Michaelis-Menten constant for phosphorus limited growth. Units are mg P/l.

TALGRH Temperature above which algal growth ceases. Units are EC or EF.

TALGRL Temperature below which algal growth ceases. Units are EC or EF.

TALGRM Temperature below which algal growth is retarded. Units are EC or EF.

5.10.1.5 Table PLNK-PARM3

ALR20 Algal unit respiration rate at 20EC. Units are 1/hr.

ALDH High algal unit death rate. Units are 1/hr.

ALDL Low algal unit death rate. Units are 1/hr.

OXALD Increment to phytoplankton unit death rate due to anaerobic conditions. Units are 1/hr.

NALDH Inorganic nitrogen concentration below which high algal death rate occurs (as nitrogen). Units are mg N/l.

PALDH Inorganic phosphorus concentration below which high algal death rate occurs (as phosphorus). Units are mg P/l.

5.10.1.6 Table PHYTO-PARM

SEED Minimum concentration of plankton not subject to advection (i.e. at high flow). Units are mg/l.

MXSTAY Concentration of plankton not subject to advection at very low flow. Units are mg/l.

OREF Outflow at which concentration of plankton not subject to advection is midway between SEED and MXSTAY. Units are ft3/sec or meters/sec.

CLALDH Chlorophyll % concentration above which high algal death rate occurs. Units are µg/l.

PHYSET Rate of phytoplankton settling. Units are feet/hr or meters/hr.

REFSET Rate of settling for dead refractory organics. Units are feet/hr or meters/hr.

5.10.1.7 Table ZOO-PARM1

MZOEAT Maximum zooplankton unit ingestion rate. Units are mg phytoplankton/ mg zooplankton-hour.

ZFIL20 Zooplankton filtering rate at 20EC. Units are 1/mg zooplankton-hour.

ZRES20 Zooplankton unit respiration rate at 20EC. Units are 1/hr.

ZD Natural zooplankton unit death rate. Units are 1/hr.

OXZD Increment to unit zooplankton death rate due to anaerobic conditions. Units are 1/hr.

5.10.1.8 Table ZOO-PARM2

TCZFIL The temperature correction coefficient for filtering.

TCZRES The temperature correction coefficient for respiration.

ZEXDEL This parameter is the fraction of nonrefractory zooplankton excretion which is immediately decomposed when ingestion rate > MZOEAT.

ZOMASS This is the average weight of a zooplankton organism. Units are mg/organism.

5.10.1.9 Table BENAL-PARM

MBAL The maximum benthic algae density (as biomass). Units are mg/m^2.

CFBALR Ratio of benthic algal to phytoplankton respiration rate.

CFBALG Ratio of benthic algal to phytoplankton growth rate.

5.10.1.10 Table PLNK-INIT

PHYTO	Initial phytoplankton concentration, as biomass. Units are mg/l.
ZOO	Initial zooplankton concentration. Units are mg/l.
BENAL	Initial benthic algae concentration, as biomass. Units are mg/l.
ORN	Initial dead refractory organic nitrogen concentration. Units are mg/l.
ORP	Initial dead refractory organic phosphorus concentration. Units are mg/l.
ORC	Initial dead refractory organic carbon concentration. Units are mg/l.

5.11 Section PHCARB

5.11.1 Time Series Data

Alkalinity is input to this section using section CONS. Section CONS supports an optional time series input, ICON. If this input is used, units for this time series are mg/l as $CaCO_3$.

5.11.2 Tabular Data

5.11.2.1 Table PH-PARM1

PHCNT	Maximum number of iterations to pH solution
ALKCON	Number of the conservative substance which is alkalinity in section CONS.

5.11.2.2 Table PH-PARM2

CFCINV	Ratio of carbon dioxide invasion rate to oxygen reaeration rate
BRCO2	Benthic release of CO_2 (as carbon) for (1) aerobic and (2) anaerobic conditions. Units are mg/m^2-hr.

5.11.2.3 Table PH-INIT

TIC	Initial total inorganic carbon. Units are mg/l.
CO2	Initial carbon dioxide (as carbon). Units are mg/l.
PH	initial pH.